LIGHT AND COLOR DEMONSTRATIONS

Changing Colors Using Pigments

This demonstration uses mixtures of food coloring to create new colors. This demonstration can be used at all grade levels, but is ideal for grades K-2. This demonstration uses pigments rather than light and in so doing creates colors by the process of subtraction, but at this level one needn't get near that complicated. Simply demonstrating the fact that there are "three primary colors—red, yellow, and blue—that can be combined to make all the other colors is sufficient (note: hopefully you realize from the workshop that the primary pigments are actually yellow, cyan, and magenta, but it is not necessary to be that technical at this level).

Kindergarten, Objective 3.2: *Recognize similar colors as being members of the family of reds, blues, and yellows …*

Items needed:

- Red, yellow, and blue food coloring
- Beaker or clear cup/glass
- Water

Directions:

1. Fill the beaker about 2/3 full of water and place it in an area where all students can see it.
2. Place one drop of first food coloring in the water and stir.
3. Place one drop of second food coloring in mixture from step 2 and stir.
4. As the food colorings mix a new color will result.
5. Colors can be made as follows:
    - Red + Yellow → Orange
    - Red + Blue → Purple
    - Yellow + Blue → Green

Notes: Red is a very dominant color, be sure to use only one drop.
Colors can be made lighter by using more water or darker by adding more food coloring.
The processes used in this demonstration are the same ones used by color printers using yellow, cyan, and magenta inks.

For some fun online practice with these color concepts go to *Carmine's Introduction to Color at* http://www.sanford-artedventures.com/play/color1/color1.html

Changing Colors Using Light

These two activities use light to demonstrate how primary colors combine to create new colors using the process of addition. The first activity uses flashlights with colored lenses and the second uses Microsoft PowerPoint to show how computer monitors make colors. This demonstration can be used at all grade levels, but is ideal for grades 4-8.

6th grade, Standard VI, Objective 2: *Describe how light can be produce… and separated into visible light of various colors.*

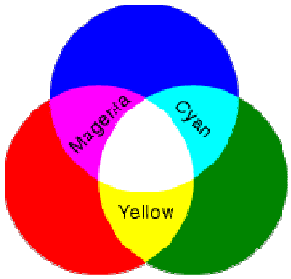
Colored Lenses Activity

Items needed:

- three flashlights with red, blue, and green colored lenses

Directions:

- Tape one of the colored lenses over the lens of each flashlight.
- Using three students as helpers, give one flashlight to each student and have them shine the light on a white wall or screen so that none of the lights overlap.
- Turn off the main lights to darken the room.
- Have students note the colors on the wall produced by the flashlights (RGB).
- Have the student holding the green colored light shine the beam directly on top of the red beam; note the color change (R + G→ yellow). Continue this process until all colors have been overlapped (G+B→ cyan, R+B→ magenta).
- Finally, overlap all three colors to produce white.
- For a fun challenge, see if students can partially overlap all three beams to produce a pattern on the wall that displays RGB, YCM, and white as show in the illustration.



Extension Activity

Tape a banana or other yellow object to the wall and shine red, then blue, then green then red and blue beams on it. What color does the banana appear? Now shine the red and green beams on it at the same time. What color do you see? Why is this happening?

Colors on Computer Monitors

Items needed:

- Computer with Microsoft PowerPoint software

Directions:

1. Open MS PowerPoint and begin with a blank slide.
2. Use the drawing tools to make a circle 10 to 15 cm in diameter. (If the drawing tool bar is not visible go to the pull-down menus and select *View, Toolbars, Drawing.* The drawing toolbar should now be on the bottom of the screen. Use the circle tool or A*utoShapes* to draw the circle.)
3. Right click on the circle and select *Format AutoShape* from the pop-up menu.
4. On the *Colors and Lines* tab is a section entitled *Fill*. Click the triangle in the *color* box and a color pallet will appear. Select *More Colors* from the color pallet menu.
5. In the Color window select the *Custom* tab. Notice that the new pallet shows the colors (ROYGBIV) going left to right and the intensities from top to bottom. Also notice that each color and intensity can be described by the primary colors red, green and blue (using the color model RGB).
6. Alter the amounts of red, green, and blue to change the color of the circle. As you do this note a few things:
    - Color values must be between 0 and 255
    - Setting all colors to 0 produces black.
    - Setting all colors to 255 produces white
    - Setting all colors to the same value will produce various shades of gray.
    - Setting any two colors to 255 and the third color to 0 will produce the secondary color, i.e. red and green at 255 and blue at 0 will produce yellow.
    - The intensity of colors from the prior step can be altered by using values less than 255, e.g. red and green at 200 and blue at 0 will produce a brown mustard color of yellow.
    - The *New*/*Current* box in the bottom right will show how the current color will be affected by the changes in the RGB values.

Extension activity: The computer monitor makes colors by adding RGB light, but printers use YCM pigments and colors by subtraction because they only reflect light, not produce it. You can see the YCM pigments on a printed page if you look at the Sunday comics from the newspaper. Use a magnifying glass and you will see that the colors you see are a combination of several small dots of YCM colors.

(color reversal/negative demo).

Refraction: changing white light into a rainbow

This demonstration illustrates how white light can be broken down into its various colors of the rainbow. This demonstration is appropriate for all grade levels, but explaining how it happens should be reserved for upper grades (i.e. 5th and 6th).

6th grade, Standard VI, Objective 2.3: Investigate and describe the refraction of light passing through various materials (e.g., prisms, water).

Items needed:

- Beaker or a cylindrical shaped glass glass.
- Water
- Small mirror
- Flashlight.

Directions:

1. Fill the beaker/glass 2/3 with water
2. Insert a small mirror in the glass and lean it against the side of the glass.
3. With the room darkened, shine the flashlight through the side of the glass and onto the mirror.
4. Look around on the wall or ceiling and you should find a rainbow.
5. If you don't see the rainbow, try changing the angle of the flashlight.